



NOTES ON AUSTRALIAN ENTOZOA, No. I.

(Communication from the Government Bureau of Microbiology,
Sydney.)

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Australian Entozoa have until now been comparatively neglected. The parasites of man and of the common domesticated animals are not accurately known. There were only occasional references scattered in medical and agricultural journals until Miss G. Sweet, D.Sc.,¹ of Melbourne, published her excellent census a few weeks ago in the Royal Society of Victoria (March, 1909), whilst this note was in the press. In order that this series of records should contain as much information as possible I preferred to amend it by incorporating Miss Sweet's new species and a few references mentioned by her, which I had no opportunity for finding. All records mentioned in Dr. Sweet's paper have accordingly been denoted thus † in front of the reference.

In all probability, many of the records of the occurrence of Entozoa in Australia are unreliable, as we know to-day that it requires a specialist to identify with certainty even common species. All specimens that I have examined will be marked with an asterisk following the locality from which the specimens were obtained.

Many parasites occur here as accidental infections, by which I mean that they have been collected in Australia from hosts that have been infected in some other country, e.g., *Schistosomum haematobium*, Bilharz, introduced from South Africa. Such Entozoa may or may not become established here. All such records, when the history is known, will be denoted (introd.)

¹ Sweet—The Endoparasites of Australian Stock and Native Fauna. Parts I. and II., Proc. Roy. Soc. Vict., xxi., (n. s.), Pt. II., 1908 (1909), p. 454.

MAN, *Homo sapiens*, Linn.*Trematoda* :—

1. *Distomum (Fasciola) hepaticum*, L.—bileduet. † Crawford, Austr. Med. Journ., ix., 1864, p. 29 (S. Aust.)—bileduet. Johnston, Agric. Gaz. N.S. Wales, xx., 1909, p. 581.
2. *Opisthorchis siuensis*, Cobbold, From Chinamen (introd.) † Jamieson, Austr. Med. Gaz., xvi., 1897, pp. 71, 147 (Sydney) : † Corlette, *ibid.*, xvi., 1897, pp. 146, 195 (Sydney) : Johnston, l.c., p. 581.
3. *Schistosomum (Bilharzia) hematobium*, Bilharz (introd. from S. Africa)—bladder. † Stacy, Austr. Med. Gaz., xxv., 1906, p. 397 (Sydney) : † Newmarch, *Ibid.* xxvi., 1907, p. 336 (Newcastle, N.S. Wales) : Johnston, Proc. Linn. Soc. N.S. Wales, xxxiv., 1, 1909, p. 118 ; Agric. Gaz. N.S. Wales, xx., 1909, p. 581 (Sydney*) : Hinder, Austr. Med. Gaz., xxiii., 1904, p. 511 (Sydney). Nash (Austr. Med. Gaz., xxvi., 1907, p. 419) points out that Newmarch's record is invalid, a statement with which I agree.

Cestoda :—

4. *Taenia solium*, L.—intestine. Johnston, Proc. Linn. Soc. N.S. Wales, xxxiv., 1, 1909, p. 118 ; Agric. Gaz. N.S. Wales, 1909, p. 582 (N.S. Wales*). There are two other references to *Taenia solium*, but the very imperfect descriptions would apply rather better to *T. saginata*, viz., Iflla, Austr. Med. Gaz. (Melbourne), 1869 (Vict.) ; Anonymous, N.S. Wales Med. Gaz., v., 1874-5, p. 57 (N.S. Wales).
5. *Taenia saginata*, Goeze (*T. mediocanellata*, Kehm.)—intestine. † Johnson, Trans. Inter. Med. Cong. Austr., 1905, p. 380 (Adelaide) ; Proc. Linn. Soc. N.S. Wales, 1909, xxxiv., 1, p. 118 ; Agric. Gaz. N.S. Wales, xx., p. 582 (N.S. Wales*).
6. *Dibothriocephalus latus*, L.—(? introduced).—There is a specimen in the Bureau Collection obtained locally, but no history is stated—intestine. Johnston, Proc. Linn. Soc. N.S. Wales, xxxiv., 1, 1909, p. 118 ; Agric. Gaz. N.S. Wales, xx., 1909, p. 582 (N.S. Wales*).
7. *Sparganum (Bothriocephalus, Lignula) mansoni*, Cobbold (*B. liguloides*, Leckt.)—peritonem and urinary tract. † Spencer, Trans. Int. Med. Congr. Austr., 1892, p. 433 (near Bathurst, N.S. Wales) : † Hill, Trans. Inter. Med. Cong. Austr., 1905, p. 368 (Sydney).

8. *Dipylidium caninum*, L.—normally from the intestine of the dog* and cat*; *Hymenolepis diminuta*, Rud., from *Mus rattus**; *M. decumanus** and *Mus musculus**; and *Hymenolepis (Drepanidotaenia) lanceolata*, Bl., from the goose*; all occur in this State. In some parts of the world, but apparently not in Australia as yet, these have occurred as accidental human parasites.
9. *Echinococcus multilocularis*, Virchow (*E. alveolaris*, Virchow), a very rare and specialised form of *E. hominis*, Rud. Munro, Austr. Med. Gaz., xxi., 1902, p. 560 (Mudgee, N.S.Wales); *id.*, xxv., 1906, p. 281 (Sydney).
10. *Echinococcus hominis*, Rud. (*E. veterinorum*, Rud., *E. hydatidosus*, Lekt., *E. polymorphus*, Dies., etc.). In nearly all organs, forming "Hydatids."

The literature is very extensive, as Hydatid disease is extremely common in Australia, and often ends fatally. The following list refers to Australian occurrences of this human parasite:—

TRANS. INT. MED. CONG. AUSTR.—

Eichler, 1892, p. 439 (N.S.W.); Gardner, 1889, p. 347 (S. Austr.); Graham, 1892, p. 427 (N.S.W.); † Johnson, 1905, p. 380 (Austr.?): MacCormick, 1905, p. 154 (N.S.W.); Marten, 1892, p. 435, (S. Austr.?): Poulton, 1892, p. 404 (Austr.); Ross, 1892, p. 437 (Austr.); Stirling, 1892, p. 408 (S. Austr.); Thane, 1892, p. 394 (N.S. Wales); † Thomas, 1887, p. 60 (Vict.); † 1889, p. 329 (Austr.); 1892, p. 378 (Austr.); 1889, p. 337 (Vict.); p. 339 (N.S.W.); p. 340 (Q'ld., S. Austr.); p. 341 (N. Z'ld., W. Austr.); p. 342 (Tas.); p. 390 (S. Austr.); Thompson, 1889, p. 385 (W. Austr.); Tremearne, 1892, p. 398 (Vict.); † Verco, 1887, p. 81 (Austr.); 1889, p. 377, p. 386 (S. Austr.); Whitcombe, 1889, p. 389 (Vict.).

AGRIC. JOURN. VICT.—

† Brown, i., 1902, p. 405 (Vict.).

TRANS. ROY. SOC. S. AUSTR.—

† Thomas, iv., 1880-81, p. 161 (S. Austr.); † vi., 1883, pp. 11, 22 (S. Austr.), p. 9 (Vict.), p. 12 (Q'ld.), p. 13 (Tas.), p. 14 (N.S.W.).

AGRIC. JOURN. QUEENSLAND.—

† Wills, ii., 1898, p. 490 (Austr.).

LANCET.—

Welsh & Chapman, 1908 (N.S. Wales).

“ENTOZOA.”—

Cobbold, 1879, p. 286 (Austr.).

“HYDATID DISEASE.”

Thomas, Adelaide, 1884, p. 56 (Vic., etc.).

ALLBUTT & ROLLESTON'S SYSTEM OF MEDICINE.—

Sterling & Verco, “Hydatid Disease,” ii., pt. ii., 1907, p. 796 (Austr.).

AUSTR. MED. JOURNAL.—

Allen iii., 1881, p. 193 (Vic.); iv., 1882, p. 160 (Vic.): † Atkinson, 1867, p. 290 (Austr.): Barrett xii., 1890 (Vic.): Bird, 1875, p. 304; iii., 1881, p. 171 (Austr.): Blair, 1875, p. 144 (Austr.): † Cooper, 1863, p. 122 (Austr.): † Dowling 1864, p. 105 (Vic.): Dunn, 1863, p. 23 (Austr.): Gardner, ix., 1887, p. 251 (S. Austr.): † Gilbee, 1862, p. 273 (Austr.): Girdlestone, x., 1888, p. 537 (Vic.): MacGillivray, 1867, p. 70 (Austr.): † Motherwell, 1862, p. 40 (Austr.): Pardey, xii., 1890 (Tasm.): Shields, xi., 1889, p. 360 (Vic.): Thomas, x., 1888, p. 457 (S. Austr.); xi., 1889, p. 306 (S. Austr., Tas.): Tracy, 1862, p. 58 (Austr.): Webb, xii., 1890 (Austr.): Zouche, v., 1883, p. 9 (Austr.): † ——, 1864, p. 46 (N.S.W.), p. 316 (N.S.W.): † Richardson, 1862, p. 9 (Austr.): † Robertson, 1862, p. 41 (Austr.).

AUSTR. MED. GAZETTE.—

Barnett, xvi., 1897, p. 222 (N.Z.): Beeston, xvi., 1897, p. 121 (N.S.W.): Brown, vii., 1887-88, p. 3 (N.S.W.): Chisholm, xii., 1893, p. 38 (N.S.W.): Cudmore, xxiii., 1904, p. 633 (S. Austr.): Fiaschi, xvii., 1898, p. 5 (N.S.W.): Fischer, xvii., 1898, p. 431 (S. Austr.); Fisher vi., 1886-7, p. 64, (N.S.W.): Fitzpatrick, xiii., 1894, p. 399 (N.S.W.): Garde, xii., 1893, p. 316 (Q'land): Gardner, x., 1890-1, p. 85 (S. Austr.): Graham, ix., 1889-90, p. 243, p. 250, (N.S.W.): Hayward, xv., 1896, p. 394 (S. Austr.): Hawkins, i., 1882, p. 1 (Austr.): Hinder, xvii., 1898, p. 348 (N.S.W.); xviii., 1889, p. 150 (N.S.W.): Jamieson, xvi., 1897, p. 598 (N.S.W.): Jenkins, v., 1885-6, p. 246 (N.S.W.): Jones, xi., 1892, p. 53 (S. Austr.): Joske, xxii., 1903, p. 406 (Vic.): Leacock, vii., 1887-8, p. 29 (N.S.W.): Lendon, xiv., 1895, p. 441 (S. Austr.): Lipscomb, xxvi., 1907, p. 124 (N.S.W.):

Macdonald, xvii., 1898, p. 348 (N. Z'd.): MacLaurin, xviii., 1899, p. 71 (N.S.W.): McMurray, xv., 1896, p. 185 (N.S.W.): Miers, xi., 1892, p. 409 (N.S.W.): Mills, MacCormick, xxiii., 1904, p. 549 (N.S.W.): Mueller, xiv., 1895, p. 43 (Vict.): Mullins, xiv., 1895, p. 44 (N.S.W., Vict., S. Austr., Q'land, Tas., N. Z'd.): Munro, xviii., 1899, p. 370 (N.S.W.): Muskett, vi., 1886-7, p. 57 (N.S.W.): Parry, xi., 1892, p. 315 (N.S.W.): Poulton, ix., 1889-90, p. 198 (S. Austr.); xii., 1893, p. 193 (S. Austr.); xv., 1896, p. 318 (S. Austr.): Reid, xxi., 1902, p. 127 (N.S.W.): Rennie, xxi., 1902, p. 547 (N.S.W.): Rennie & Crago, xix., 1900, p. 270 (N.S.W.): Russell, xxvi., 1907, p. 514 (Vict.): Ryan, xiv., 1895, p. 392 (Vict.): Sawkins, xii., 1893, p. 363; xiii., 1894, p. 7 (N.S.W.); xxvii., 1908, p. 179 (N.S.W.): Scott, xii., 1893, p. 142 (Vict.): Shewen, vi., 1886-7, p. 13; ix., 1889-90, p. 134 (N.S.W.): Shuter, xviii., 1899, p. 246 (S. Austr.): Smith, xiii., 1894, p. 219 (N.S.W.): Sprott, xiv., 1895, p. 440 (Tas.): Stevenson, xi., 1892, p. 376 (Tas.): Stewart, xii., 1893, p. 302 (S. Aust.): Stirling, viii., 1888-9, p. 39 (S. Austr.); xiv., 1895, p. 315 (S. Austr.), p. 316 (N.S.W., Vict.), p. 317 (Tas., W. Austr., N. Z'd), p. 318 (Q'd): Thane, vii., 1887-8, p. 159 (N.S.W.): Thomas, vi., 1886-7, p. 215 (S. Austr.); vii., 1887-8, pp. 190, 216 (S. Austr.); ix., 1889-90, pp. 72-73 (S. Austr.): Thomson, xiii., 1894, p. 191 (N.S.W.): Turner, x., 1890-1, p. 65 (Q'land): Vance, xvii., 1898, p. 431 (S. Austr.): Vaughan, vi., 1886-7, p. 191 (S. Austr.): Verco, xii., 1893, p. 295 (S. Austr.); xv., 1896, p. 321 (S. Austr.): Verco and Poulton, xxiii., 1904, p. 265 (S. Austr.); xxvii., 1908, p. 290 (S. Austr.): Watson, xiv., 1895, p. 161 (N.S.W.); xv., 1896, p. 303 (S. Austr.); xxv., 1906, p. 617 (Austr.): Welsh and Barling, xxv., 1906, p. 383 (N.S.W.): Welsh and Chapman, xxvii., 1908, p. 1 (N.S.W.), p. 653 (N.S.W.): Wilson, xxiv., 1905, p. 469 (Vict.): MacLaurin, xxviii., 1909, p. 295 (N.S. Wales).

N.S.W. MED. GAZETTE.—

Brady, v., 1874-75 (N.S.W.): Morgan, iv., 1873-4, p. 377 (N.S.W. and Vict.): Wright, ii., 1871-2, p. 363 (N.S.W.): —, iv., 1873-4, p. 371 (N.S.W.).

JOURN. SYD. UNIV. MEDICAL SOCIETY.—

Parkinson and MacCormick, i, 1908, p. 13 (N.S.W.): Storey, i., 1908, p. 77 (N.S.W.).

AGRIC. GAZ. N.S. WALES—

Johnston, xx., 1909, p. 582.

Journ. Trop. Med. Hyg.—Cleland and Cumpston, xi., 1908, p. 165 (W. Austr.).

Nematoda :—

10. *Strongyloides intestinalis*, Bavay (*Anguillula*, *Rhabdonema stercoralis*, Bavay)—intestine. Ashwood, Austr. Med. Gaz., xv., 1896, p. 482 (Q'land) : Johnston, Agric. Gaz. N.S. Wales, xx., 1909, p. 583 (Q'land).
11. *Trichinella (Trichina) spiralis*, Owen—muscles. † Austr. Med. Journ., 1870, p. 318 (Tasm., introd. from Germany), † 1871, p. 224 (N.S. Wales) : † Johnson, Austr. Med. Gaz., xxi., 1902, pp. 120, 415 (S. Austr.*); † Trans. Inter. Med. Cong. Austr., 1905, pp. 370, 380 (S. Austr.): Johnston, loc. cit., p. 583.
12. *Trichocephalus trichiurus*, Linn. (*T. dispar*, Rud.)—caecum. Hogg, Austr. Med. Gaz., viii., 1888-9, p. 133 (Q'land) : † Bancroft, xii., 1893, p. 258 (Q'land, N.S. Wales) : † Mollison, Inter. Med. Cong. Austr., 1898, p. 417 (N.S.W., Q'land) : † Lawes, Austr. Med. Gaz., xiv., 1895, p. 446 (Q'land) : Johnston, Proc. Linn. Soc. N.S. Wales, xxxiv., 1, 1909, p. 119 (N.S. Wales*); Agr. Gaz. N.S. Wales, xx., 1909, p. 583 (N.S. Wales*).
13. *Eustrongylus gigas*, Dies.,?—kidney. Allan, Austr. Med. Gaz., xvi., 1897, p. 607 (N.S. Wales). I think that the reference is doubtful, judging by the account given.
14. *Ankylostoma (Dochmias) duodenale*, Dubini.—intestine. † Ashworth, Austr. Med. Gaz., xv., 1896 p. 482 (Q'land) : † Bancroft, Austr. Med. Gaz., xii., 1893, p. 258 (N. Q'land); xxi., 1902, p. 66 (Q'land); Trans. Inter. Med. Cong. Austr., 1896, p. 101 (Q'land) : Bacot, Austr. Med. Gaz., xiv., 1895 (Q'land) : † Gibson and Turner, Trans. Inter. Med. Cong. Austr., 1892, p. 134 (N. Q'land) : † Hogg, Austr. Med. Gaz., viii., 1888-9, p. 133 (Q'land) ; † Brit. Med. Journ., 1889, i., p. 792 (Q'land) : † H. Kenny, Austr. Med. Gaz., xxv., 1906, p. 399 (Q'land) : † Lawes, *Ibid.*, xiv., 1895, p. 445 (Tweed R., N. S. Wales, Q'land) : † O'Brien, *Ibid.*, xxvii., 1908, p. 121 (Q'land) : Turner, Trans. Inter. Med. Cong. Austr., 1896, p. 101 (Q'land) ; † Proc. Roy. Soc. Q'land, xi., 1895, p. 99 ; Austr. Med. Gaz., xxviii., 1909, p. 351 (Q'land, Northern N. S. Wales) : Johnston, Agr. Gaz. N. S. Wales, xx., 1909, p. 583 : Salter, Austr. Med. Gaz., xxviii., 1909, p. 355 (Q'land).
15. *Necator americanus*, Stiles—intestine. Salter, Austr. Med. Gaz., xxviii., 1909, p. 355 (Q'land).

16. *Ascaris lumbricoides*, Linn.—intestine. † Sweet, Proc. Roy. Soc. Vict., 1908 (1909), p. 515 (Vict.): Johnston, Proc. Linn. Soc. N. S. Wales, xxxiv., 1909, p. 119 (N. S. Wales*); Agr. Gaz. N. S. Wales, xx., 1909, p. 583 (N. S. Wales*). Dr. J. B. Cleland brought under my notice a reference to the presence of "teres" or roundworms in children in the early days of New South Wales, by Surgeon P. Cunningham, in his work, "Two years in New South Wales" (2nd ed.), i., 1827, p. 172. This refers to the above species since *Lumbricus teres* is one of its former names, and is probably the first published reference to Australia Entozoa.

17. *Oxyuris vermicularis*, Linn.—intestine, usually in children. † Cobb, Proc. Linn. Soc. N. S. Wales, (ii.), v., 1890, p. 168 (N. S. Wales): Johnston, *ibid*, xxxiv., 1909, p. 119 (N. S. Wales*); Agr. Gaz. N. S. Wales, xx., 1909, p. 583 (N. S. Wales*).

18. *Filaria medinensis*, Velsch, † Macgillivray, Austr. Med. Journ., v., 1860, p. 172 (Vict., introd.): Johnston, Agr. Gaz. N. S. Wales, xx., 1909, p. 583 (Vict.).

19. { *Filaria bancrofti*, Cobbold—lymphatics.
 { *Microfilaria nocturna*, Manson (*Filaria sanguinis hominis*, Lewis), the larva of *F. bancrofti*—blood.

Cobbold, Journ. Linn. Soc., Zool., xiv., 1879, p. 356 (Q'land); Parasites (Entozoa), 1879, pp. 186, sqq. (Q'land); Lancet, 1877, pp. 70, 495 (Q'land); Brit. Med. Journ., 1876 (Austr.); Lancet, 1877, pp. 70, 495 (Q'land); *Ib.*, ——, 1878 (Q'land); *Ib.*, 1877; Brit. Med. Journ., 1876 (Austr.): Braun, Animal Parasites of Man, Eng. transl. 1906, pp. 289, 291 (Q'land): † Bancroft, Austr. Med. Journ., iv., 1882, p. 361 (Q'land); † Austr. Med. Gaz., xii., 1893, p. 258 (Q'land); † Trans. Inter. Med. Cong. Austr., 1889, p. 49 (Q'land); Austr. Med. Gaz., xvii., 1898, p. 271 (Q'land); † Journ. Roy. Soc. N. S. Wales, xxxiii., 1899 (1900), p. 48 (Q'land); Austr. Med. Gaz., xviii., 1899, p. 120 (Q'land); Jour. Trop. Med. Lond., 1899-1900, ii., pp. 91, 149, 1901, i., p. 822 (Q'land); † Austr. Med. Gaz., xxii., 1903, p. 251 (Q'land): Bancroft and Jackson, *Ibid.*, xiii., 1894, p. 6 (Q'land): Jackson, *Ibid.*, xii., 1893, p. 260 (Q'land): † Colledge, Proc. Roy. Soc. Q'land, xv., 1900, p. 127 (Q'land): † Flynn, Austr. Med. Gaz., xxii., 1903, p. 248 (Q'land): † Johnson, Trans. Inter. Med. Cong. Austr., 1905, p. 380 (S. Austr.): Manson and Shipley in Allbutt and Rolleston's Syst. Medicine, ii., part ii., pp. 933, 936 (Q'land, Samoa): Turner, Austr. Med. Gaz., x., 1890-1,

p. 65 (Q'land) : Looss, Handb. d. Tropenkrankh., i., 1905, p. 162 (Austr.) : Johnston, Agric. Gaz. N.S. Wales, xx., 1909, p. 583 (Q'land, N.S. Wales, S. Austr., W. Austr.), p. 581 (W. Austr.). Dr. Cleland showed me North-west Australian specimens, and Dr. O'Neill informed me that he commonly met with *Filaria nocturna* in Sydney* (introduced).

20. *Filaria demarquayi*, Manson?—blood. † Manson, Tropical Diseases, Lond., 1898, p. 446 (N. Guin) : Braun, Animal Parasites, Eng. transl., 1906, p. 297 (N. Guin) : Looss, Handb. d. Tropenkrankh., i., 1905, p. 169 (N. Guinea) : Johnston, *loc. cit.*, p. 583.

We will only mention certain Acarida which are really Ectozoa, though they live below the surface, *e.g.*,² *Sarcoptes scabiei*, Linn., and *Demodex folliculorum*, Simon,³ both occurring in N. S. Wales,* the latter in Tasmania also.

Protozoa :—

21. *Entamoeba coli*, Loesch.—intestine. I have seen examples obtained in Sydney.

22. *Entamoeba histolytica*, Schaudinn (*Amoeba dysenterica*)—in cases of tropical dysentery and certain abscesses of the liver. Verco, Austr. Med. Gaz., xviii., 1899, p. 66 (S. Austr.) : O'Brien, *id.*, xviii., 1899, p. 390 (Q'land) : Fiaschi, *id.*, xvii., 1898, p. 511 (N. S. Wales) : Ibsbister, *id.*, xvii., 1898, p. 512 (N. S. Wales) : Goldsmith, Trans. Inter. Med. Cong. Austr., 1902, p. 180 (N. Terr., S. Austr.) : Johnston, *loc. cit.* p. 581 (N.S. Wales). Dr. Finckh has shown me specimens obtained in Sydney.

23. *Entamoeba buccalis*, Sternberg ?—in dental caries. I have seen amoeba-like bodies from decaying teeth, which, probably belong to this species. Johnston, *loc. cit.*, p. 581 (N. S. Wales).

Several species of *Flagellata* occur here, *viz.* :—

24. *Spirochaeta refringens*, Schaudinn, associated with the organism allied to syphilis. N. S. Wales and all other States. Johnston, *loc. cit.*, p. 581.

25. *Spirochaeta aboriginalis*, Cleland (MSS.), in a granuloma allied to syphilis. Cleland, Trans. Inter. Med. Cong. Austr., 1908 (in press), (W. Austr.*); Austr. Med. Gaz.,

² Rainbow—Rec. Austr. Mus., vi., 3, 1906, p. 189 (N. S. Wales, Vict.).

³ Lea—Insect and Fungus Pests, etc. Tasm., 1908, p. 106 (Tasmania).

xxviii., 1909, p. 304 (W. Austr.): Cleland and Hickinbotham, Journ. Trop. Med. Hyg., xii., 1909, p. 143, (W. Austr., N. Terr., Thursday I.): Johnston, *loc. cit.*, p. 581.

26. *Spirochaeta vincenti*, R. Bl.—mouth. I have seen specimens from West Australia and N. S. Wales (Dr. Cleland, Dr. Finckh).
27. *Spirochaeta dentium*, Koch (? syn. *S. buccalis*, Cohn.)—teeth. N. S. Wales* (Dr. Finckh): Johnston, *loc. cit.*, p. 581.
28. *Spirochaeta pertenuis*, Castellani, associated with "yaws." McGregor, Trans. Inter. Med. Cong. Austr., 1889, p. 47 (Brit. N. Guin., Solomons, N. Hebrides, Samoa, Fiji, Tonga, adjacent islands): Plehn, Handb. d. Tropenkrankh., i., 1905, p. 60 (N. Guin., Fiji.). Cases have occurred in Queensland and New South Wales, the disease having been contracted in the Pacific Islands.—(Dr. O'Neill, Dr. Cleland).
29. *Treponema (Spirochaeta) pallidum*, Schaudinn, the parasite of syphilis. Most of the following references are to the disease, not to the organism, but to make the list complete I have preferred to include them:—Bird, Austr. Med. Gaz., xi., 1889 (Austr.), xxiv., 1905, p. 446 (Austr.): Bowe, Trans. Inter. Med. Cong. Austr., 1889, p. 61 (Q'land): Cleland, Austr. Med. Gaz., xxii., 1903, p. 68 (S. Austr.): Clatworthy, x., 1891, p. 140 (N. Q'land): Davidson, *id.* xxviii., 1909, p. 174 (N. S. Wales): Fiaschi, *id.* xxvii., 1908, p. 294 (N. S. Wales): Herring, *id.* xxi., 1902, p. 70 (Vict.): Hinder, *id.* xx., 1901, p. 92 (N. S. Wales): Hogg, *id.* xiii., 1894, p. 365 (N. S. Wales): Kenny, *id.* xviii., 1898, p. 531 (Vict.): McMurray, *id.* xxvii., 1908, p. 652 (Austr.): xxviii., 1909, p. 77 (N. S. Wales); xxviii., 1909, p. 388 (N. S. Wales): MacLaurin, N. S. Wales Med. Gaz., v., 1874-5, p. 163 (N. S. Wales): Marten, Austr. Med. Gaz., xxi., 1902, p. 608 (S. Austr.): Munro, xxv., 1906, p. 341 (N. S. Wales); xxiv., 1905, p. 637 (N. S. Wales): Ryan, Trans. Inter. Med. Cong. Austr., 1889, p. 994 (Vict.): Stirling, 1899, p. 991 (Vict.): Austr. Med. Journ., xii., 1890 (Austr.): Syme, xii., 1890, p. 221 (Vict.); Trans. Inter. Med. Cong. Austr., 1889, p. 771 (Vict.): —— Austr. Med. Gaz., xxvii., 1908, p. 674 (Vict.): Johnston, *loc. cit.*, p. 581 (W. Austr., N. S. Wales). Dr. Cleland showed me slides of *T. pallidum* from New South Wales* and West Australia.
30. *Plasmodium (Haemamoeba, Laverania), malariae*, Laveran—the parasite of quartan fever (erythrocytes of the blood).

The Sporozoa are represented by the malaria parasites.

31. *Plasmodium vivax*, Gr. and Fel.—tertian fever parasite.

32. *P. falciparum*, Lemaire (*P. immaculatum*, Gr. and Fel.)—parasite of tropical or aestivo-autumnal fever. The references to malaria in Australasia are as follows:—Dyson, Trans. Inter. Med. Cong. Austr., 1889, p. 64 (N. Q'land—the three types of fever) : Hudson, Austr. Med. Gaz., xvi., 1897, (N. Z'd); xvii., 1898, p. 225 (N. Z'd) : Hunt, x., 1890-1, p. 75 (N. Q'land) ; Trans. Int. Med. Cong. Austr., 1892, p. 598 (N. Q'land) : James, Austr. Med. Gaz., x., 1890-1, p. 300 (N. Q'land) : Turner, x., 1890-1, p. 65 (Q'land) : Johnson, Trans. Austr. Med. Cong., 1905, p. 370 (S. Austr.). Malaria (especially tertian) occurs in Sydney* (Dr. Finckh, Dr. O'Neill), the disease being contracted in New Guinea, New Hebrides, and other Pacific Islands ; and it occurs also in North West Australia* (Dr. Cleland) and Northern Territory : Johnston, *loc. cit.*, p. 581 (N.S. Wales, W. Austr.).

33. *Cytoryctes variolae*, Guarn.—cowpox organism.

34. *Cytoryctes vacciniae*, Guarn.—smallpox organism. Both of these occur in the blood corpuscles. Their protozoan nature is still doubted by some authorities. These two diseases occur in every state of Australasia. Nearly all the following references relate to smallpox. Coutie, Austr. Med. Gaz., iv., 1885, p. 118 (N. S. Wales) : Haynes, *id.* xii., 1893, p. 211 (W. Austr.) : Lendon, *id.* iv., 1885, p. 61 (S. Austr.) : MacLaurin, *id.* vi., 1887, p. 104 (W. Austr.) : Mullins, *id.* xv., 1896, p. 501 (N. S. Wales), xvi., 1897, pp. 74, 376, 492 (N. S. Wales), xvii., 1898, p. 57 (Vict.), p. 147 (N. S. Wales), p. 431 (S. Austr.) : Muskett, iv., 1884-5, p. 57 (N. S. Wales) : Pardy, Austr. Med. Journ., x., 1888, p. 193 (Tas.) : Rowling, Austr. Med. Gaz., iv., 1884-5, p. 114 (N. S. Wales) : Stow, *id.* vi., 1886-7, p. 175 (Pt. Darwin) : Thompson, *id.* iv., 1884-5, p. 62 (N. S. Wales) : —————, Austr. Med. Gaz., 1869 (1870), pp. 2, 10, etc. (Vict.) ; *id.* iv., 1884-5, p. 240 (N. S. Wales) ; *id.* v., 1885-6, p. 179 (N. S. Wales) ; *id.* vii., 1887-8, p. 16 (Tas.), p. 97 (Tas., Vict., S. Austr.) ; *id.* xii., 1893, p. 19 (S. Austr.), p. 165 (W. Austr.) ; Austr. Med. Journ., ix., 1887, p. 193 (Tas.) : Tidswell, Proc. Austr. Assoc. Adv. Sc., 1898 (N.S. Wales, S. Austr., Vict.).

Two fairly common tropical diseases, Beri-beri and Dengue fever, are at present regarded as being produced by the presence of undiscovered protozoa.

Beri-beri :—

Molloy, Trans. Inter. Med. Cong. Austr., 1892, p. 101 (Vict., from China) : White, *id.* 1902, p. 185 (Thursday I.) : Wood, *id.* 1889, p. 54 (N. Terr.) : Hayward, Austr. Med. Gaz., xxi., 1902, p. 614 (S. Austr.) : Jamieson, *id.* xvi., 1897, p. 71 (N. S. Wales) : Nall, *id.* xvii., 1898, p. 149 (Q'land, N. S. Wales, Vict., W. Austr.) : Paton, *id.* xiii., 1894, p. 363 (N. S. Wales). Dr. O'Neill informed me that beri-beri is often met with in Sydney, though contracted elsewhere.

Dengue :—

Manson in Allbutt and Rolleston, Syst. Medicine, ii., pt. ii., p. 346 (Fiji) : Baneroff, Austr. Med. Gaz., xxv., 1906, p. 17 (Q'land) : Gibson, *id.* xxv., 1906, p. 227 (Q'land) : Hare, *id.* xvii., 1898, p. 98 (Q'land) : Gibson, *id.* xvii., 1898, p. 339 (Q'land) : Bowkett, xvii., 1898, p. 177 (Q'land) : —, *id.* xxiv., 1905, p. 617 (Q'land) ; *id.* xxvi., 1907, 265 (Fiji).

Dr. Johnson briefly describes and figures an organism, "a rare worm," from the renal tract of a boy (Austr. Med. Gaz., xxi., 1902, p. 524)—S. Australia. The description does not allow of the parasite being assigned to any particular animal group. I have disregarded all references to the occurrences of unnamed "worms," unless the description is such as to enable one to identify the organism.

HORSE—*EQUUS CABALLUS*, Linn.*Cestoda* :—

1. *Anoplocephala mamillana*, Mehlis—small intestine. † Cobb, Agr. Gaz. N. S. Wales, xvi., 1905, p. 630 (N. S. Wales) : Johnston, Agr. Gaz. N. S. Wales, xx., 1909, p. 583 (N. S. Wales*).
2. *Anoplocephala perfoliata*, Goeze—caecum. † Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 821 (N. S. Wales) : † Cobb, *Ibid.*, xvi., 1905, p. 631 (N. S. Wales) : Johnston, *Ibid.*, xx., 1909, p. 583 (N. S. Wales*) : † Brown, Agr. Journ. Vict., i., 1902, p. 698 (Vict.?) : † Desmond, Journ. Agr. Ind. S. Austr., ix., 1905-6, pp. 248, 252 (S. Austr.) : † Sweet, Proc. Roy. Soc. Vict., xxi., (2), 1908 (1909), p. 505 (Vict.). Mr. A. M. Lea informed me of its occurrence in Tasmania.
3. *Anoplocephala plicata*, Rud.—small intestine. † Cobb, Agr. Gaz. N. S. Wales, xvi., 1905, p. 628 (N. S. Wales) : Johnston, *Ibid.*, xx., 1909, p. 583 (N. S. Wales*, Fiji*) : † Desmond, loc. cit., ix., 1905-6, p. 249 (S. Austr.) : † Sweet, loc. cit., p. 505 (Vict.). Dr. Cleland brought me specimens from West Australia.*

The above Cestodes do not appear to be common. This applies especially to the first and last, *A. mamillana* being quite rare. *A. plicata* may grow to much larger dimensions than that given in most descriptions of this worm, some that I have examined reaching fourteen and a-half inches in length by one and a quarter in breadth.

4. *Echinococcus veterinorum*, Rud. (*E. polymorphus*, Dies.)—kidney. † Sweet, *loc. cit.*, p. 506 (Viet.). I have examined specimens collected by Dr. Cleland from a horse at Berry, N.S. Wales.*

Nematoda :—

5. *Ascaris megalocephala*, Cloq.—small intestine. † Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 821 (N. S. Wales) : Johnston, *Ibid.*, xx., 1909, p. 583, 584 (Fiji*, N. S. Wales*): † Brown, Australian, 1897, ii., p. 224 (Viet.?) : † Sweet, *loc. cit.*, p. 514 (Viet.): † Desmond, *loc. cit.*, vii., 1903-4, p. 570; ix., 1905-6, p. 252 (S. Austr.): † von Linstow, *Arch. Naturg.*, lxiii., 1897, p. 282 (Bismarek Archpg.): — W. Austr. (informed by Dr. Cleland).

6. *Oxyuris curvula*, Rud.—large intestine. † Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 822 (N. S. Wales) : Johnston, *ibid.*, xx., 1909, p. 583 (N. S. Wales*, Tas.*).

The variety often termed *O. mastigodes*, Nitzsch, I have taken near Bathurst, New South Wales. Johnston, *loc. cit.*, p. 583.

7. *Sclerostomum equinum*, Müller, (*syn. Strongylus armatus*, Rud.)—caecum, large intestine, intestinal muscles, arteries. † Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 821 (N. S. Wales): † Desmond, *Journ. Agr. Ind. S. Austr.*, viii., 1904-5, p. 569, and ix., 1905-6, p. 952 (S. Austr.): † Brown, *Agr. Journ. Viet.*, iii., 1905, p. 144 (Viet.).

This so-called species has been shown by Looss to contain a number of distinct species, some of which are mentioned below.

8. *Sclerostomum edentatum*, Looss.—stomach and intestine. † Sweet, *loc. cit.*, p. 507 (Viet.): Johnston, *loc. cit.*, p. 583 (N. S. Wales*).

9. *Sclerostomum vulgare*, Looss—stomach, intestine. † Sweet, *loc. cit.*, p. 508 (Viet.).

10. *Sclerostomum sp.*—stomach. † Weir, *Agr. Journ. Viet.*, ii., 1904, p. 242 (Viet.).

11. *Triodontophorus intermedius*, Sweet—stomach, intestine (?). † Sweet, *loc. cit.*, p. 511 (Viet.).

12. *Cylichnóstomum calicatum*, Looss—stomach, intestine (?).
† Sweet, *loc. cit.*, p. 513 (Vict.).
13. *Cylichnóstomum poculatum*, Looss—stomach, intestine (?).
† Sweet, *loc. cit.*, p. 511 (Vict.).
14. *Cylichnóstomum (Sclerostomum) tetricanthonm*, Dies—
† Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 821 (N. S. Wales):
Johnston, *ibid.*, xx., 1909, p. 583 (N. S. Wales*).
15. *Cylichnóstomum spp.* ——stomach, intestine. † Sweet,
loc. cit., pp. 511, 512 (Vict.).
16. *Sclerostomum (Dochminus) hypostomum* (Dies)—tumours in
stomach. † Desmond, Journ. Agr. Ind. S. Austr., vii., 1904,
p. 519 (S. Austr.).
17. *Eustrongylus gigas*, Dies—kidneys. † Brown, Australasian,
1896, ii., p. 1262 (Vict.).
18. *Filaria loa*, Guyot (*Dracunculus oculi*, Dies)—eye. † Brown,
Australasian, 1896, ii., p. 1262 (Vict.?).
19. *Spiroptera megastoma*, Rud.—stomach (tumours). † Desmond,
loc. cit., ix., 1905-6, p. 252 (S. Austr.): † Perrie, Agr. Gaz.
N. S. Wales, iii., 1892, p. 822 (N. S. Wales): Johnston,
ibid., xx., 1909, p. 583 (N. S. Wales*): Henry, *ibid.*, xx.,
1909, p. 579 (N. S. Wales): † Weir, Journ. Dept. Agric.
W. Austr., xii., 1905, p. 60 (W. Austr.).
20. *Spiroptera microstoma*, Schneider—stomach (tumours).
† Perrie, Agr. Gaz. N. S. Wales, iii., 1892, p. 822
(N. S. Wales): Johnston, *id.* xx., 1909, p. 583 (N. S.
Wales*): Cleland, Dep. Agr. W. Austr., Bull. 33, 1908
(1909), p. 3; *ibid.*, Bull. 34, 1909, p. 15 (W. Austr.).
21. *Strongylus micrurus*, Mehlis—lungs, bronchi. † Perrie,
loc. cit., iii., 1892, p. 821 (N. S. Wales).
22. *Trypanosoma evansi*, Steel, “surra”—experimental, Cleland.
“*Trypanosomiasis*,” Dep. Agr. W. Austr., Bull. 34, 1909,
pp. 5, 14 (W. Austr.).

Diptera (e.g., larvae of bot-flies).

23. *Gastrophilus equi*, Fabr.—stomach. † Perrie, *loc. cit.*, iii., 1892,
p. 822 (N. S. Wales): ——, Agr. Gaz. N. S. Wales, xx.,
1909, p. 203 (Vict. and N. S. Wales): † Brown, Australasian,
1894, i., p. 190 (Vict.): Agr. Journ. Vict., ii., 1904, p. 634
(Vict.): † French, Agr. Journ. Vict., i., 1902, p. 693 (Vict.):
† Thompson, Journ. Council Agr. Tas., ii., 1894, p. 76
(Tasm.): Lea, Insect and Fungus Pests, etc., Hobart,

1908, p. 99 (Tasm.): Stewart, Agr. Gaz. N. S. Wales, xvi., 1905 (Vict., N. S. Wales): Johnston, *Ibid.*, xx., 1909, p. 583 (N. S. Wales*): † Desmond, Journ. Agr. Ind. S. Austr., ix., 1905-6, p. 252 (S. Austr.): † ——, Agr. Ind. S. Austr. iv., 1901-2, pp. 523, etc. (S. Austr.).

24. *Gastrophilus haemorrhoidalis*, Linn.—rectum. Stewart, *loc. cit.*, March, 1905 (N. S. Wales): Johnston, *loc. cit.*, p. 583 (N. S. Wales*): ——, Agr. Gaz. N. S. Wales, xx., 1909, p. 203 (Vict., N. S. Wales): † Desmond, *loc. cit.*, ix., 1905-6, p. 252 (S. Austr.): † Brown, Agr. Journ. Vict., ii., 1904, p. 635 (Vict.?).

25. *Gastrophilus nasalis* (*G. salutaris*, Walker)—stomach. † Helms, Journ. Agric. W. Austr., i., 1899, p. 23 (W. Austr.): Froggatt, Agr. Gaz. N. S. Wales, xi., 1900 (N. S. Wales, Vict.): Johnston, *loc. cit.*, p. 583 (N. S. Wales*).

26. *Gastrophilus*, sp.—† Stewart, *loc. cit.*, xi., 1900, p. 841 (N. S. Wales): † Williams and Webb, Journ. Agr. Ind. S. Austr., iii., 1900, p. 622 (S. Austr.): † Brown, Agr. Journ. Vict., v., 1907, p. 448 (Vict.): † ——, Journ. Agr. W. Austr. x., 1904, p. 43 (W. Austr.): † Despeissis, Journ. Agr. W. Austr., xiv., 1906, p. 450 (W. Austr.): Froggatt, Agr. Gaz. N. S. Wales, xix., 1908, p. 229 (N. S. Wales).

By far the commonest species of bot-fly larvae which I have examined is *G. nasalis*, *G. equi* and *G. haemorrhoidalis*, especially the latter, being rather uncommon. No doubt, very many of the references to *G. equi* should be to *G. nasalis*.

The specimens of *Anoplocephala perfoliata*, *Gastrophilus nasalis*, and *Ascaris megalcephala* recorded above from Fiji were taken from a mule there. Johnston, Agr. Gaz. N. S. Wales, xx., 1909, p. 584.

RABBIT—*ORYCTOLAGUS (LEPUS) CUNICULUS*, Linn.

Protozoa :—

1. *Coccidium oviforme*, Lenckt. (*C. cuniculi*, Riv.)—liver and intestine. Johnston, Agr. Gaz. N. S. Wales, xx., 1909, p. 584 (N. S. Wales*).

Cestoda :—

2. *Cysticercus pisiformis*, Zeder—mesentery. † Brown, Agric. Journ. Vict., i., 1902, p. 614 (Vict.): † Sweet, Proc. Roy. Soc. Vict., xxi., (2), 1908 (1909), p. 506 (Vict.): Johnston, Agric. Gaz. N. S. Wales, xx., 1909, p. 584 (N. S. Wales*).

3. *Caenurus serialis*, Gervais—muscles. † Sweet, *loc. cit.*, p. 507 (Vict.): Johnston, *loc. cit.*, p. 584 (N. S. Wales*).
4. *Echinococcus veterinorum*, Rud. (*E. polymorphus*, Dies.)—† Sweet, *loc. cit.*, p. 506 (Vict.): Johnston, *loc. cit.*, p. 584 (N. S. Wales*).

Miss Sweet has apparently overlooked an error in her paper where a reference to the occurrence of *Taenia serrata*, Goeze, in the intestine of a dog in N. S. Wales († Cobb, Agric. Gaz. N. S. Wales, xvi., 1905, p. 314) has been set down on p. 478, as from a rabbit.

Nematoda :—

5. *Spiroptera megastoma*, Rud.—intestine. † Brown, Australasian, 1896, ii., p. 1262 (Vict.).
6. *Strongylus strigosus*, Duj.—stomach. Johnston, *loc. cit.*, p. 584 (N. S. Wales*).

HARE—*LEPUS TIMIDUS*, *Linn.*

Cestoda :—

1. *Cysticercus pisiformis*, Zeder.—mesentery. † Brown, Agr. Journ. Vict., i., 1902, p. 614 (Vict.): † Sweet, Proc. Roy. Soc. Vict., xxi., (2), 1908 (1909), p. 506 (Vict.).
2. *Coenurus serialis*, Gerv. Cambr. Nat. Hist., ii., Worms, p. 82 (Austr.).

GUINEA PIG—*CAVIA CUTLERİ*, Bennet.

Cestoda :—

1. *Cysticercus pisiformis*, Zeder.?—mesentery. Johnston, Agr. Gaz. N. S. Wales, xx., p. 481 (N. S. Wales*).

Nematoda :—

2. *Trichinella spiralis*, Owen—experimental animal, fed with trichinised human flesh. Johnson, Austr. Med. Gaz., xxi., 1902, p. 415 (Adelaide).
3. *Trypanosoma evansi*, Steel—(experimental), Cleland, “*Trypanosomiasis*,” *loc. cit.*, p. 10 (West Austr.).

GOAT—*CAPRA HIRCUS*, *Linn.*

Cestoda :—

1. *Cysticercus tenuicollis*, Dies. West Australia (collected by Dr. J. B. Cleland). This is the first Australian reference to an entozoon from this host. Johnston, Agr. Gaz. N. S. Wales, xx., p. 584 (W. Austr.).

SPARROW—*PASSER DOMESTICUS*, *Linn.**Cestoda* :—

1. *Monopylidium passerinum*, Fuhrmann—intestine. Johnston, Agric. Gaz. N. S. Wales, xx., 1909, p. 584 (Sydney, N. S. Wales*).

Sporozoa :—

2. *Plasmodium praecox*, Gr. and Fel.? (syn., *Proteosoma danielowskyi*, Kruse)—in erythrocytes. Johnston, Agric. Gaz. N. S. Wales, xx., 1909, p. 584 (Sydney, N. S. Wales*).

SUN FISH—*MOLA MOLA*, *Linn.**Trematoda* :—

1. *Distomum contortum*, Rud.—on gills. † Macleay, Proc. Linn. Soc. N. S. Wales, i., 1875-7, p. 12 (Port Stephens, N. S. Wales).
2. *Anchistrocephalus microcephalus*, Rud.—intestine. (Port Stephens, N. S. Wales*). † Macleay, loc. cit., p. 12, and from a Sunfish mentioned by Stead, Proc. Linn. Soc. N. S. Wales, 1908, (4), p. 797, taken off the coast of N. S. Wales*.
3. *Tetrarhynchus (Rhynchobothrius) reptans*, Wag., syn., *Anthocephalus elongatus*, Rud.)—encysted in muscles and viscera. † Macleay, loc. cit., p. 12 (Port Stephens*).
4. *Cysticercus*, sp.?—intestine. † Macleay, loc. cit., p. 12 (Port Stephens, N. S. Wales).

The above four references occur again in the N. S. Wales Med. Gaz., v., 1874-5, pp. 175-6.

In conclusion, I wish to thank the Trustees for publishing this paper; the Director of the Bureau of Microbiology, Dr. F. Tidswell, for permission to incorporate information acquired officially by me; Dr. J. B. Cleland and Dr. A. E. Finckh, my colleagues in the Bureau, for references and specimens; Mr. M. Henry, M.R.C.V.S., of Stoek Department; Mr. A. M. Lea, of Tasmania, and Mr. F. H. Taylor for forwarding specimens.

I have examined all the Entozoa contained in the Museum collections which relate to the animals mentioned in the paper.